

ENVIRONMENTAL Fact Sheet



29 Hazen Drive, Concord, New Hampshire 03301 • (603) 271-3503 • www.des.nh.gov

ARD-EHP-35

2010

Beryllium: Health Information Summary

Beryllium is a naturally occurring element that is present in a variety of materials including rocks, soil, coal and oil. It is found at concentrations ranging from 1 to 15 parts per million (ppm) in rocks at the earth's surface and at lower concentrations in soil. Because of its special properties of light weight, heat resistance, and hardness, beryllium is used for specialized applications in electronics fabrication and as a component of systems used in the aerospace, defense, and nuclear power industries.

Beryllium is present in air, soil and water as the result of a number of natural and manmade activities. Beryllium concentrations in groundwater are usually very low. In the State of New Hampshire, elevated levels of beryllium, presumably leaching from bedrock, have been found in some public drinking water wells in the Mt. Washington Valley area. Dug wells are not expected to contain high levels of beryllium. Beryllium is found at very low levels in many foods (fruits, vegetables, meats and shellfish). Beryllium concentrations in air are normally very low. Almost all airborne beryllium is due to oil and coal combustion. Coal ash is an important man-made source of concentrated beryllium that can pollute soil and groundwater if not disposed of properly.

Health Effects

Absorption/Metabolism

The most important way that people are exposed to beryllium is by breathing in vapors or dust. Studies have found that ingestion of beryllium results in less than one percent of it being absorbed. Absorbing it through the skin was found to be negligible. Therefore inhalation is the most important exposure pathway.

Short-Term (Acute) Effects

Breathing in air containing high levels of beryllium can cause an inflammatory response in the lung called acute beryllium disease. Symptoms include nasal irritation, sore throat, weight loss, fatigue, and reduced breathing capacity. Skin exposure to concentrated beryllium can result in an allergic skin response. Nodules composed of immune cells known as (skin) granulomas can form. Skin exposure can also cause contact dermatitis, an inflammatory response, with symptoms of redness, irritation, and itching.

Long-Term (Chronic) Effects

Long-term inhalation exposure to beryllium in the workplace may cause an immune system response resulting in lung granulomas, which are non-cancerous nodules. Symptoms of the lung immune response to beryllium, known as chronic beryllium disease (CBD), include tiredness, cough, weight loss, and heart disease. The time period from the initial exposure to beryllium until CBD symptoms first appear averages between 10 and 15 years. Only a small percentage of the population is believed to be susceptible to CBD; susceptible individuals who do not yet have the disease can be identified by testing certain blood cells that fight disease. Although CBD is mainly confined to those occupationally exposed, it has also been found in the families of beryllium workers and in communities with industries that use or process beryllium.

Carcinogenicity (ability to cause cancer)

There is evidence that occupational inhalation exposure to beryllium increases the risk of lung cancer. The results of animal studies strengthen the possible link between breathing beryllium and increased lung cancer risk. Beryllium is currently categorized by the EPA as a “likely human carcinogen.” The U.S. Department of Health and Human Services and the International Agency for Research on Cancer have determined that beryllium and beryllium compounds are human carcinogens. In several studies in which animals were administered beryllium in food or water, researchers did not find increases in tumors. There is not enough evidence available, however, to determine whether consuming food or water containing beryllium increases the risk for cancer.

Reproductive/Developmental Effects

Developmental effects observed in a study of pregnant rats given high doses of beryllium included increased fetal death and increased number of offspring with internal abnormalities.

Health Standards and Criteria

The EPA has established a Maximum Contaminant Level (MCL) for beryllium in public drinking water systems. MCLs are enforceable drinking water standards determined by balancing the adverse health effects of a particular chemical against the feasibility and cost of treating contaminated water. The MCL is set at 4 parts per billion (ppb).

The EPA has also established a Maximum Contaminant Level Goal (MCLG) for beryllium in public drinking water systems at 4 ppb. MCLGs are non-enforceable health standards for drinking water. MCLGs are set at a level at which no adverse health effects would be expected to result from the consumption of two liters (0.53 gallons) of contaminated water per day by a 70 kg (154 lb) adult. The MCLG is based on the gastrointestinal effects observed in laboratory animals.

The Occupational Safety and Health (OSHA) Administration enforceable standard (permissible exposure limit or PEL) for beryllium in workplace air is two micrograms per cubic meter ($\mu\text{g}/\text{m}^3$) averaged over eight hours exposure. This standard was established in 1970 and most occupational health professionals no longer consider it to be sufficiently protective. The Department of Energy (DOE) guideline for breathing beryllium in workplace air is $0.2 \mu\text{g}/\text{m}^3$. It should be noted that

concentrations of beryllium in ambient (outdoor) air are usually several orders of magnitude below the levels recommended by OSHA and DOE.

For more information, please contact the DES Environmental Health Program, 29 Hazen Drive, Concord, NH 03302-0095; (603) 271-4608.

Suggested Reading and References

Casarett and Doull's Toxicology: The Basic Science of Poisons, Sixth Edition. Klaassen, C.D., ed. McGraw-Hill Publishing Co. Inc., New York, 2001.

Toxicological information on beryllium. Integrated Risk Information System (IRIS). U.S. EPA, Office of Health and Environmental Assessment. Last significant revision April 1988.

Toxicological Profile for Beryllium (Update). Agency for Toxic Substances and Disease Registry (ATSDR). Atlanta, Ga. September, 2002.

Case Studies in Environmental Medicine: Beryllium Toxicity. Agency for Toxic Substances and Disease Registry (ATSDR). Atlanta, Ga. May, 2008.